

structural integrity of the composite laminate in addition to providing a gas barrier, weatherability and wear resistance. A biaxial fabric or resin film is not required to achieve the following strengths: Tensile strength 453 to 3500 kg/5cm, Tear strength 400 to 1633 kg and a base cloth weight of 277 to 742 g/m<sup>2</sup>. Conventional airships and aerostats are produced utilizing a biaxial ply to achieve increased tear strength from a composite skin (envelope/gas bag).

Please replace the paragraph bridging pages 1 and 2 with the following:

In large volume, in excess of 15 to 60 million cubic feet of Helium, the material used for the envelope/gas bag of non-rigid airships must meet a large number of design requirements such as high strength, provide tear resistance, act as a gas barrier, not be subject of degradation by ultra violet radiation due to exposure to sunlight, and must resist wind erosion. Thus such a material winds up being a multi-layer laminate combining materials with diverse properties. The tension stress loads on any portion of the wall of the envelope/gas bag are at 0 degrees to the longitudinal axis of the envelope/gas bag or 90 degrees thereto (circumferential) hereinafter referred to as axial loads. Thus most laminates include woven filamentary material with the filamentary material orientated at 0 to 90 degree angles. Additionally, to absorb shear stress loads, filamentary material is often included with orientations at plus or minus forty-five degrees to those absorbing the axial tension loads.

Please replace the paragraph bridging pages 2 and 3 with the following:

Some modern designs use woven polyester fiber as the axial load carrying material, in addition to a polyester terephthalate film, which provides a Helium gas barrier and absorbs shear loads. However, in large non-rigid airships with volume in excess of 15 to 60 million cubic feet of Helium, the strength requirements have dictated the use of very high strength materials such as an extended chain polyethylene fiber or a thermotropic liquid (melt spun) crystalline polymer fiber.

Please replace the second paragraph of page 3 with the following:

U.S. Patent No. 6,074,722, "Flexible Material For An Inflatable Structure" by R. S. Cuccias, filed February 2, 1997 disclosed a material wherein bias shear load carrying plies had a greater strain to failure value than the axial tension load carrying. The invention included a first flexible layer comprising unidirectional filamentary material at 0 to 90 degrees to each other. A second flexible layer was included having unidirectional filamentary material at 0 to 90 degrees to each other and at forty-five degrees in the filamentary material of the first layer. Critical to the invention was the requirement that the strain value at failure for the filamentary material of the second layer be greater than the 0 and 90 degree filamentary material of the first layer. Of course, the first and second layers were bonded together by a resin, and an additional film as a gas impermeable material and an ultra violet radiation resistant material were bonded to the first two layers. However, such materials are difficult to manufacture accurately with plies at both 0 and 90 degrees and at plus or minus 45 degrees.

Please replace the second paragraph of page 4 with the following:

A flexible wall material for use in an airship with a volume in excess of 15 to 60 million cubic feet of Helium. In detail, the material is a multi-layer cloth assembly including at least two plies of fiber cloth, with the fiber of the individual cloth layers having a denier generally between 180 to 280 with the fill of the individual plies at 90 degrees to each other and a total weight of between 150 to 478 g/m<sup>2</sup>. The permeability is less than 1 liter/m<sup>2</sup>/day/atm. Preferably, the material has a weight of 150 to 450 g/m<sup>2</sup> and an architectural weave comprising 56 by 56 yarns/inch. An optional structural envelope/gas bag laminate is composed of 2 to 6 plies of a modified Rip Stop (58 by 58 yarns/inch) weave with extended chain polyethylene fiber and having a total weight of 159 to 478 g/m<sup>2</sup>. VECTRAN fibers made by Celanese Acetate LLC of Charlotte, N.C. and SPECTRA fibers made by Honeywell Performance Fibers of Morristown, N.J. are applicable materials. Both candidate materials are laminated to an amorphous, thermoplastic polyurethane (TPUR) elastomer film between each ply providing the structural integrity of the composite laminate in addition to providing a gas barrier, weatherability and wear resistance.

Please replace the first paragraph under the heading "Description of the Preferred Embodiment" at page 6 with the following:

Illustrated in Figure 1 is a perspective view of very large non-rigid airship with a volume in excess of 15 to 60 million cubic feet of Helium, generally designated by the numeral 10. The vehicle 10 includes an envelope/gas bag 12 having a longitudinal axis 13A, lateral axis 13B and a vertical axis 13C. It should be understood that the vehicle 10 could be constructed from a series of separate envelope/gasbags joined together to form the illustrated shape. A gondola 14 is suspended from the envelope/gas bag 12 and incorporates a plurality of propulsion systems 16 mounted thereon. If the vehicle is very large, enormous stress levels can be introduced into the envelope/gas bag 12.

Please replace the second paragraph under the heading "Description of the Preferred Embodiment" at page 6 with the following:

Additionally, the envelope/gas bag 12 must be impervious to Helium gas; not be affected by ultra-violet radiation; and capable of being seamed together from a large number of panels. Meeting all these requirements requires a laminated multi-layer flexible cloth assembly having specific mechanical properties.

Please replace the first paragraph of page 7 with the following:

In Figure 2, a portion of the envelope/gas bag 20 is illustrated having an inside surface 22 and outside surface 24 and is composed of multiple layers of filamentary material in a manner to be subsequently discussed. The main stress loads are introduced along the 0 degree axis, aligned with the longitudinal axis 13A, and indicated by numeral 26, and 90 degrees thereto indicated by numeral 28. Thus the main load carrying filamentary material should be aligned with these axes.

Please replace the second paragraph of page 7 with the following:

Referring to Figure 3 the envelope/gas bag 20 is made by forming a stack 42 by laying up four layers of woven cloth 42A, 42B, 42C, and 42D, with the threads 43

of each layer woven in a 2x2 basket weave architecture. The denier of the cloth is between 180 and 280 and, preferably between 200 and 215. The threads 43 of the layers 42 are made of a thermotropic liquid (melt spun) crystalline polymer fiber. The fill of each layer 42A-D alternates between 0 and 90 degrees to each other layer. Resin sheets 46 are placed on the inside and outside surfaces 22 and 24 of the layers 42 and also between each layer 42A-D. The resin sheets are preferably made from a thermoplastic polyurethane (TPUR) elastomer, because the envelope/gas bag 20 is a gasbag for a non-rigid lighter-than-air ship 10. A fifth layer 48 of a material that is resistant to degradation by ultra violet radiation such as a polyester terephthalate is bonded to the outside surface 24. As illustrated in Figure 3, the material is illustrated in its "lay-up form" for purposes of illustration. When the layers are bonded together, the sheets of resin 46, flow together and impregnate the layers of cloth 42A-D. Thus the layers 42A-D can be said to be encapsulated in a resin matrix and the envelope/gas bag 20 can be characterized as a flexible composite material.

Please replace the paragraph bridging pages 7 and 8 with the following:

Referring to Figure 4, in a second embodiment, the envelope/gas bag 20 is made from forming a stack 62 by laying up to six layers of woven cloth 62A, 62B, 62C, 62D, 62E and 62F, with the threads 63 of each layer woven in a modified rip stop weave architecture. Again the denier is between 180 and 280 with the preferred range of 180 to 215. As illustrated, the threads 63 are made of extended chain polyethylene. The fill of each layer 62A-F alternates between 0 and 90 degrees to each other. Resin sheets 66 are placed on the inside and outside surfaces 22 and 24 of the stack 62 and also between each layer 62A-F. The resin sheets 66 are also preferably made from polyurethane elastomer resin. A seventh layer 68 of a material that is resistant to degradation by ultra violet radiation is bonded to the outside surface 24, again a polyester terephthalate film. The envelope/gas bag 20 is again illustrated in its "lay-up form" for purposes of illustration. As in the previous example, when the layers are bonded together, the sheets of resin 66, flow together and impregnate the layers of cloth 62A-F. Thus again, the layers can be said to be encapsulated in a resin matrix and the envelope/gas bag 20 can be characterized as a flexible composite material.